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AUTHOR(S):

Poulin, P.

CITATION:

Poulin, P.. Liquid crystal-colloid composites(Soft Matter as Structured Materials). 物性研究 2005, 84(6): 854-855

ISSUE DATE:

2005-09-20

URL:

http://hdl.handle.net/2433/110335

Liquid crystal - colloid composites

P. Poulin

Centre de Recherche Paul Pascal - CNRS, Bordeaux, France.

The aim of this presentation is to show the great richness of composites made of colloidal inclusions in liquid crystalline media. As an introduction to the field, we review important features of such systems. Spherical inclusions induce distortions and topological defects of the continuous liquid crystalline matrix. The nature of the more classical defects and distortions around micron sized inclusions has been experimentally and theoretically scrutinized over the last 8 years. It has been demonstrated that these distortions can mediate elastic interactions between the colloids and direct the spatial ordering of the suspended particles. Such phenomena offer exciting opportunities to create new structures with ordered colloids. We also show that these phenomena can play an important role in phase separations of binary fluids and be used to produced monodisperse and aligned emulsions (1). Recent results in different smectic liquid crystals and cholesteric liquid crystals will be also presented (2).

The response of liquid crystal - colloid composites to an electrical field exhibits distinctive features when compared to classical colloids. The distortions around the particles can be modified by the electrical field and, in contrast with classical electro-rheological fluids, inclusions in liquid crystals can be stabilized in directions along which they repel each other. These unique features may offer opportunities for creating novel field responsive fluids (3).

More recently, we have started to investigate dynamical properties of such systems and determined the mobility of a colloidal inclusions in a nematic film (4). We propose the first experimental measurements of the anisotropy of the diffusion coefficients in such media. The experimental results are in good agreement with previous theoretical expectations.

In spite of extensive studies over the last few years, liquid crystal - colloid composites are remaining extremely rich systems with a variety of phenomena, structures and properties to be discovered in the future. The behavior of anisotropic

inclusions, nanoparticles, the possibility to link a finite number of particles by new topological conformations, and pre-transitionnal effects are among the most exciting challenges for future studies. It will also be particularly important to investigate physical properties such as optical, rheological or electrorheological properties of this new class of complex fluids.

References

(1) J.C. Loudet, P. Barois, P. Poulin, **Nature 407**, 611-613 (2000)
(2) P. Cluzeau, P. Poulin, G. Joly, H.T. Nguyen, **Phys. Rev. E 63,** 31702 (2001); J.C. Loudet, H. Richard, P. Auroy, P. Keller, P. Poulin, **Langmuir 20** 11336-11347 (2004).
(3) J.C. Loudet, P. Poulin., **Phys. Rev. Lett. 87,** 165503 (2001)
(4) J.C. Loudet, P. Hanusse, P. Poulin, **Science 306** 1525 (2004)